Appendix E

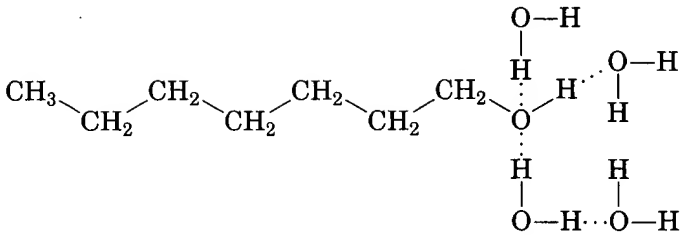
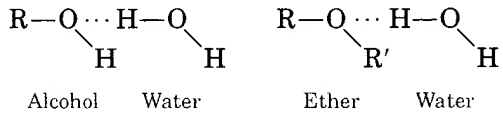


Figure 12.1
Water molecules surround the —OH end of 1-heptanol but do not come near the alkyl end. Because the alkyl end is unsolvated, 1-heptanol is insoluble in water.

reason is hydrogen bonding. Both alcohols and ethers have an oxygen atom, so both can form hydrogen bonds with water and so can dissolve.



Ethers can form hydrogen bonds with water but not with other ether molecules, because water has the group —OH but an ether molecule does not.

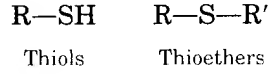
Alcohols and ethers of higher molecular weight, however, do not dissolve in water because the water molecules cannot solvate the large R groups. For example, consider 1-heptanol. This molecule consists of an alkyl chain of seven carbons and an —OH group. As shown in Figure 12.1, the —OH forms hydrogen bonds with and is surrounded by water molecules, but the alkyl portion of the molecule has *no* attraction for water molecules. Because this part of the molecule cannot be surrounded by water molecules, 1-heptanol is insoluble in water.

We call this part of the molecule *hydrophobic,* meaning water-hating.

As you might expect, the physical properties of phenols are much like those of alcohols of similar molecular weight.

12.8 Thiols, Thioethers, and Disulfides

Thiols and thioethers are sulfur analogs of the corresponding alcohols, phenols, and ethers (Table 12.1),



Thiols are also called mercaptans, and thioethers are also called sulfides.

but are much less important chemically. Three properties of thiols are worth mentioning here.

1. Thiols have foul odors. You generally don't expect organic compounds to have pleasant odors (although some do), but thiols smell so bad that chemical companies put the word "stench" on the labels. The liquid squirted by skunks is a mixture of thiols and closely related compounds.

Gas companies take advantage of the odor of thiols. Natural gas (methane) has no odor, so the companies add a tiny amount of methanethiol, CH_3SH, so that gas leaks can be detected before a spark or a match sets off an explosion.

2. Thiols are weak acids, somewhat weaker than phenols.
3. Thiols are easily oxidizable to disulfides: